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June 13, 2007

VIA ELECTRONIC FILING

Marlene H. Dortch, Secretary
Federal Communications Commission
445 12th Street, S.W.
Washington, DC 20554

Re: **NOTICE OF *EX PARTE* MEETINGS**

ET Docket No. 04-186; Unlicensed Operation in the TV Broadcast Bands

Dear Ms. Dortch:

On June 12, 2006, Shure Incorporated ("Shure") met with the Office of Engineering and Technology ("OET") to discuss Docket No. 04-186. Julius Knapp, Ron Chase, Ira Keltz, Alan Stillwell, Geraldine Matise, Rashmi Doshi, Thomas Phillips, Steve Martin, Le Hung Quang, Saurbh Chhabra and Harry Wong were in attendance on behalf of OET. Attending this meeting on behalf of Shure was Ahren Hartman, Principal Engineer, and Edgar Reihl, Principal Engineer, along with Catherine Wang and Timothy Bransford of Bingham McCutchen LLP, outside counsel.

During this meeting Shure discussed the fundamental requirement that an unlicensed device's ("UD's") sensing range must match or exceed its ability to radiate emissions capable of interfering with Part 74 devices in the "white spaces." Shure also discussed how prohibiting unlicensed operations in certain channels, namely channels adjacent to assigned TV channels, and a number of unoccupied TV channels in rural areas, as well instituting a smart beacon system for super-scale events, are essential measures necessary to provide minimal interference protection for Part 74 devices if the Commission ultimately approves unlicensed operations in the "white spaces." During the course of the meeting Shure also informed the Commission of recent progress at IEEE regarding the development of a technical standard for a protective beacon intended for use in the broadcasting bands, and the critical need for field testing under real-world conditions to effectively evaluate the ability of proposed interference protection measures to protect wireless microphones.

A short presentation provided to OET during the meeting on June 12, 2007 is attached to this letter for inclusion in the record.

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If you have any questions regarding these meetings, please do not hesitate to contact the undersigned.

Very truly yours,

/s/

Catherine Wang
Timothy L. Bransford

cc (by email): Julius Knapp
Ron Chase
Ira Keltz
Alan Stillwell
Geraldine Matise
Rashmi Doshi
Thomas Phillips
Steve Martin
Le Hung Quang
Saurbh Chhabra
Harry Wong

"White Spaces"
Wireless Microphone Solutions

12 June 2007

Shure Incorporated

SHURE

Recent Activities

- DTV Receiver testing conclusions
  - DTV receivers are vulnerable to interference from unlicensed device (UD) in adjacent channels
  - Tests were done on a conducted basis only and did not address the issue of direct pickup interference. This is a serious concern for UD operating in consumers' homes
  - Tests were designed to exclude the effects of UD spurious emissions. IEEE analysis indicated that UD spurious emissions would need to be reduced ~30 dB from 15.209 limits in order not to interfere from adjacent channels

Recent Activities

- IEEE 802.22
  - Draft beacon standard P802.22.1-D1 completed with Shure participation
  - Letter ballot voting now open (through July 8th)
- R&O and FNPRM comments
  - Ruled to only allow fixed devices (Portable prohibited from 14-20 due to interference concerns to PLMRS → same as wireless microphone issue)
  - Some support lowering power of p/p devices to 10-20mW (e.g. comments of NCTA, IEEE)
  - Spectrum sensing / DFS discussion (5GHz example)
- Unlicensed Device prototype submissions
  - Few devices submitted
  - Laboratory and "Real-World" testing essential!

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UD / Microphone Testing

- Shure is prepared to participate in unlicensed device and microphone testing
  - Suggested venues to test unlicensed device prototypes in real-world environments
    - Independence Day Celebration
    - House of Worship location
    - Live news location
    - Sporting event location
    - Broadway play
    - Las Vegas production
- Also suggest laboratory bench testing as previously proposed to the FCC (January 25, 2007)

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UD / Microphone Testing

Venue #1 – **Independence Day Celebration, Washington, D.C.**

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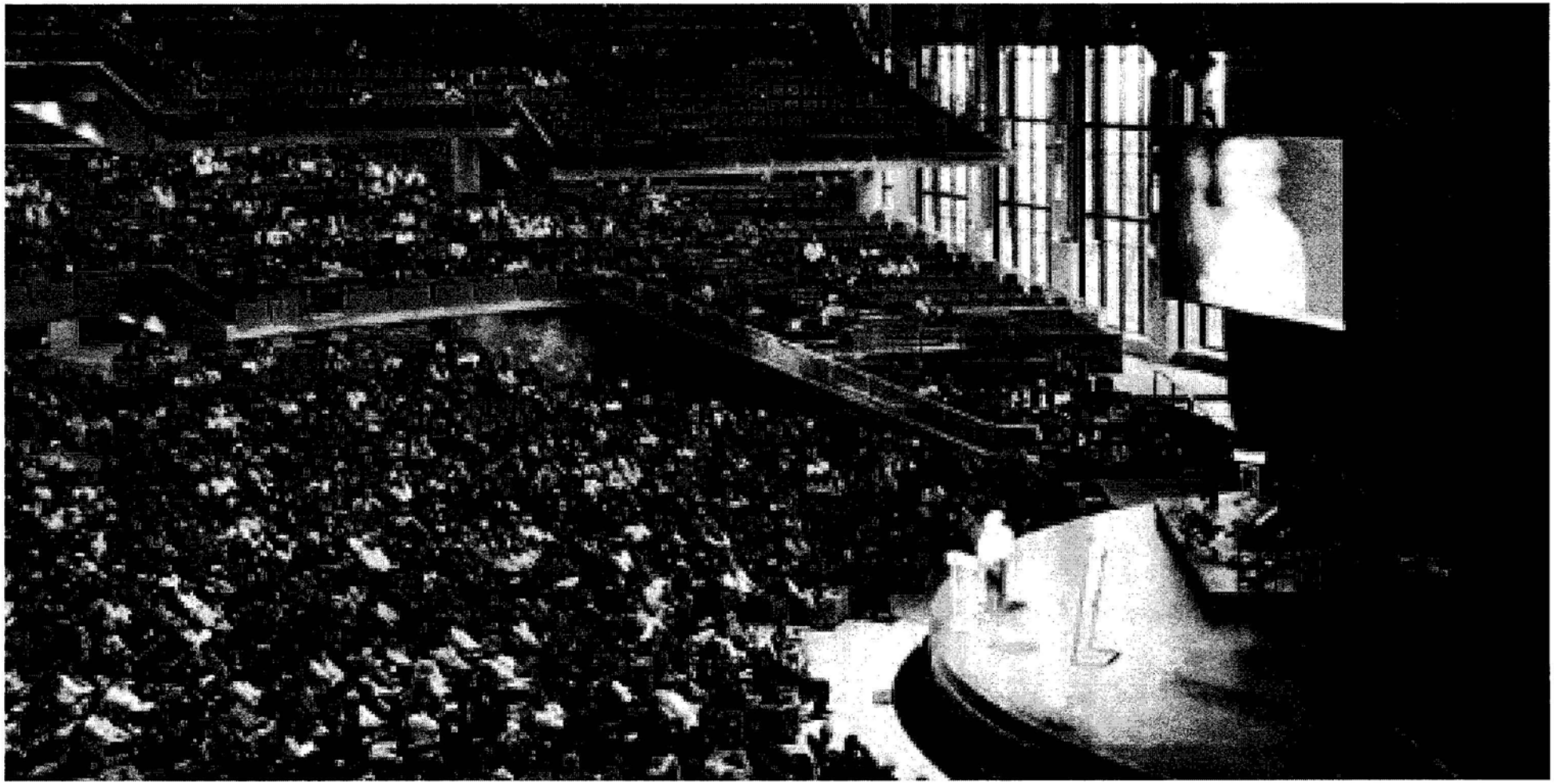
UD / Microphone Testing



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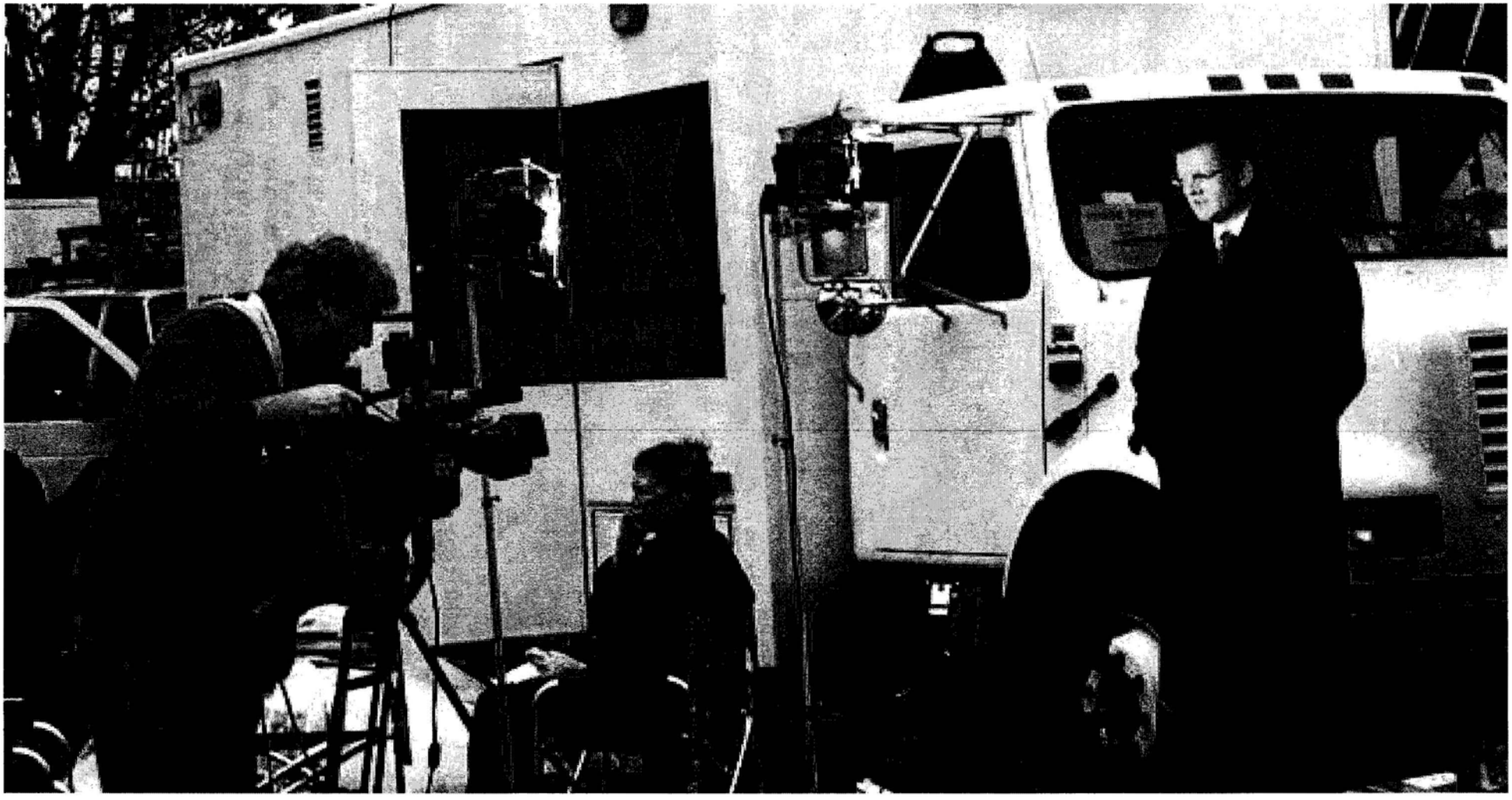
Venue #2 – **House of Worship Broadcast**

UD / Microphone Testing



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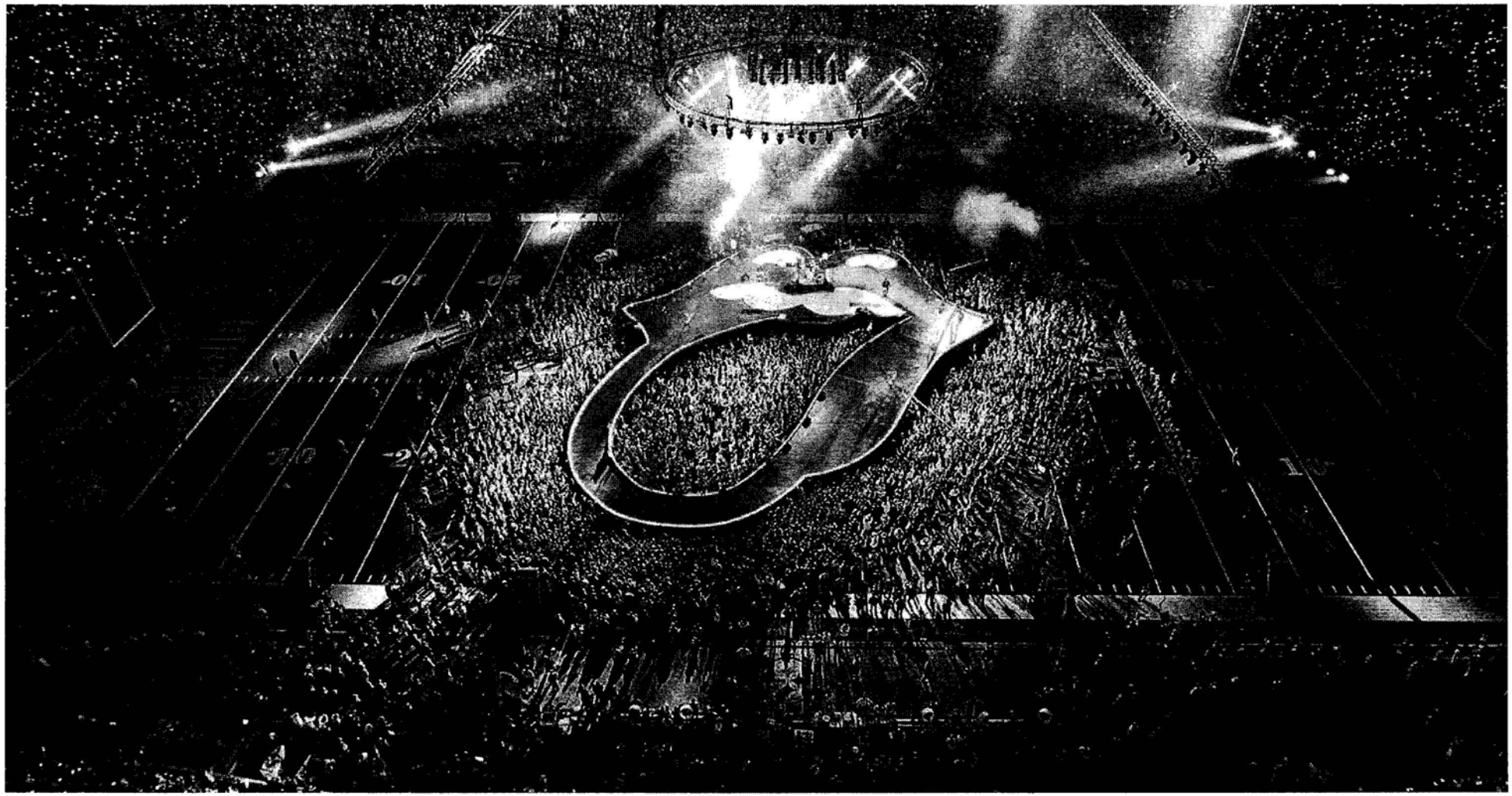
Venue #3 – **Live News Broadcast**

UD / Microphone Testing



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Venue #4 – **Sporting Event | Music Broadcast**

UD / Microphone Testing

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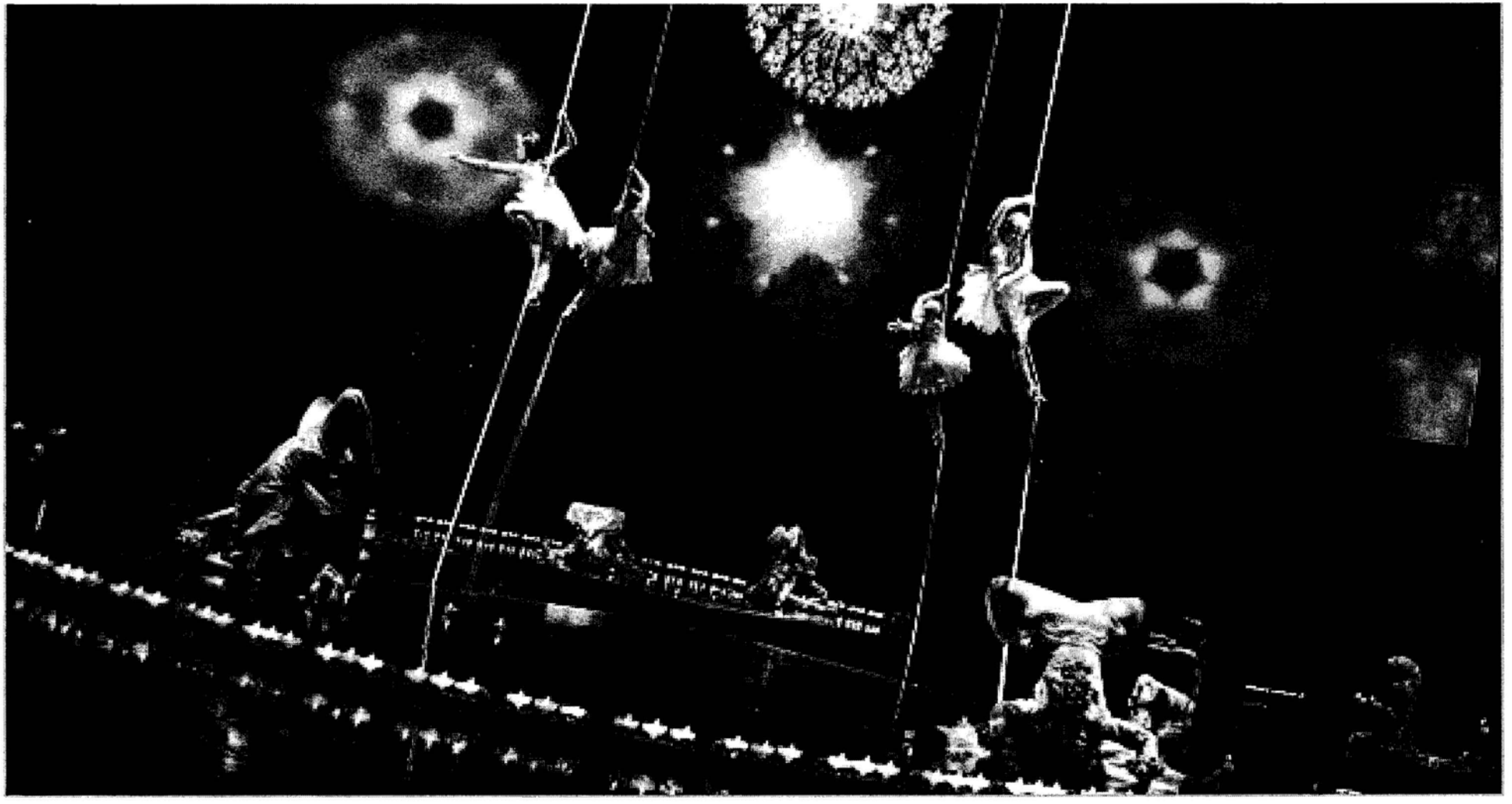
Venue #5 – **Broadway Play**

UD / Microphone Testing



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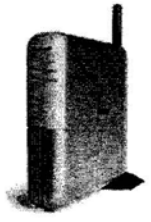
Venue #6 – **Las Vegas Production**

Spectrum Sensing

- **EXAMPLE**: Sensing a wireless microphone from a personal/portable unlicensed device

PARAMETERS:

- Unlicensed Device TX = 100mW
- Wireless Microphone TX = 10mW
- Sensing threshold for microphone = -114dBm*
- "OPEN" HATA propagation model



Unlicensed Device (UD)

Microphone Transmitter

* Proposed by the "White Spaces Coalition" prototype submission, March 14, 2007

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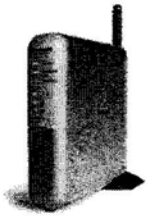
EXAMPLE: Spectrum Sensing

Microphone Sensing Path Loss:
+ 10dBm TX microphone
- 10dB (antenna and body loss)*
- (- 114dBm) sensing threshold
= **+114dB Path Loss**



Unlicensed Device UD (100mW)

Microphone Transmitter

* Antenna and body loss model from Shure Comments, Nov. 2004

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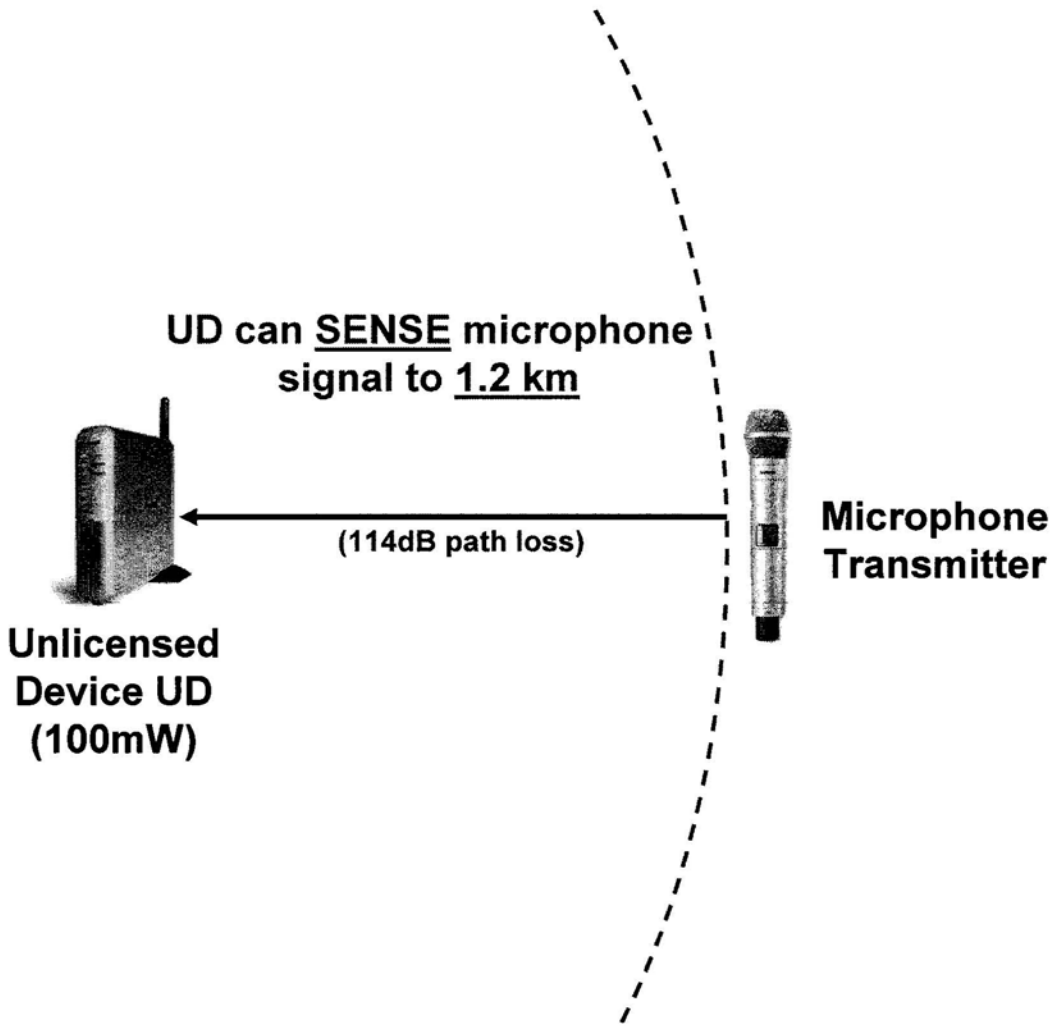
EXAMPLE: Spectrum Sensing



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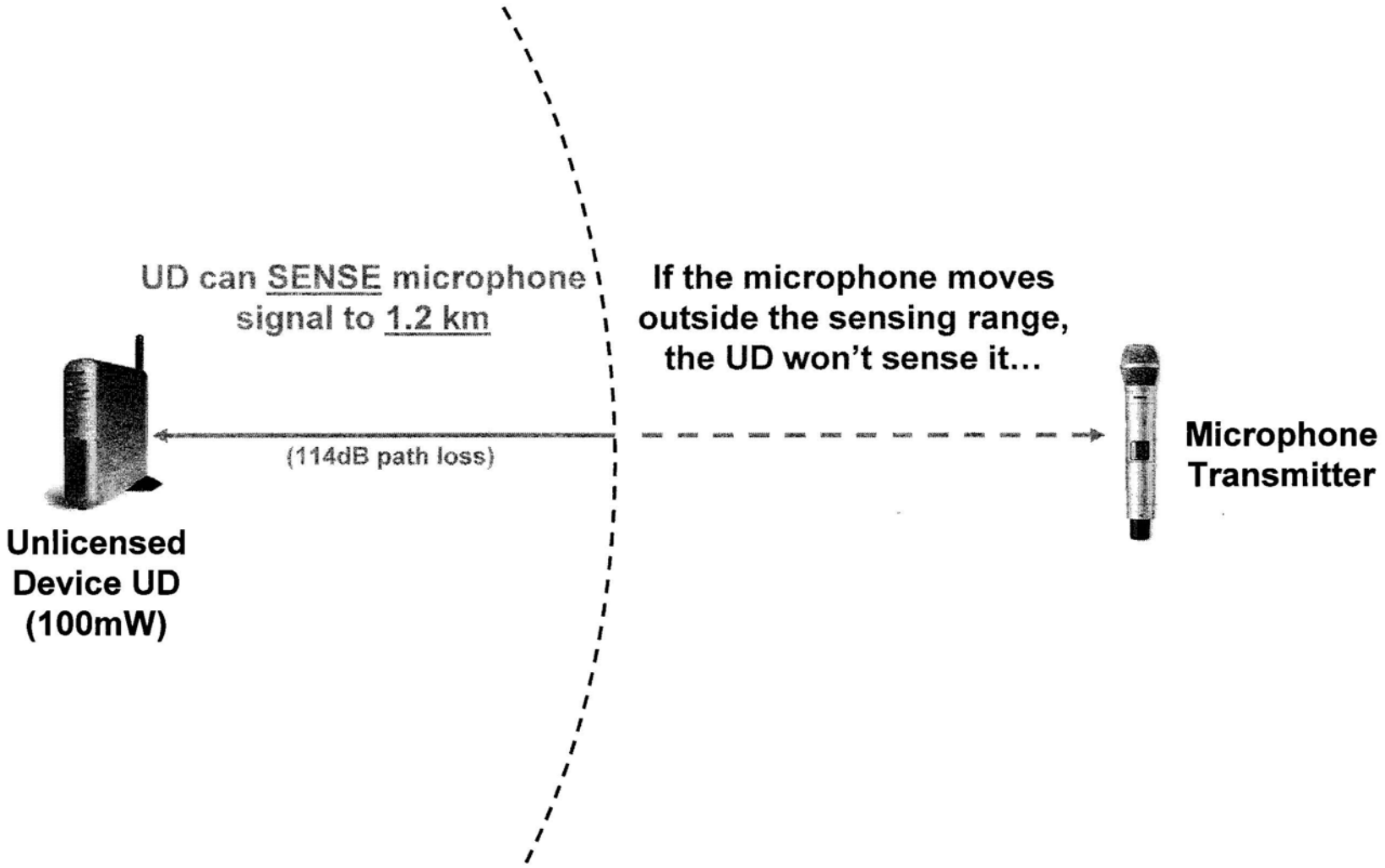
EXAMPLE: Spectrum Sensing



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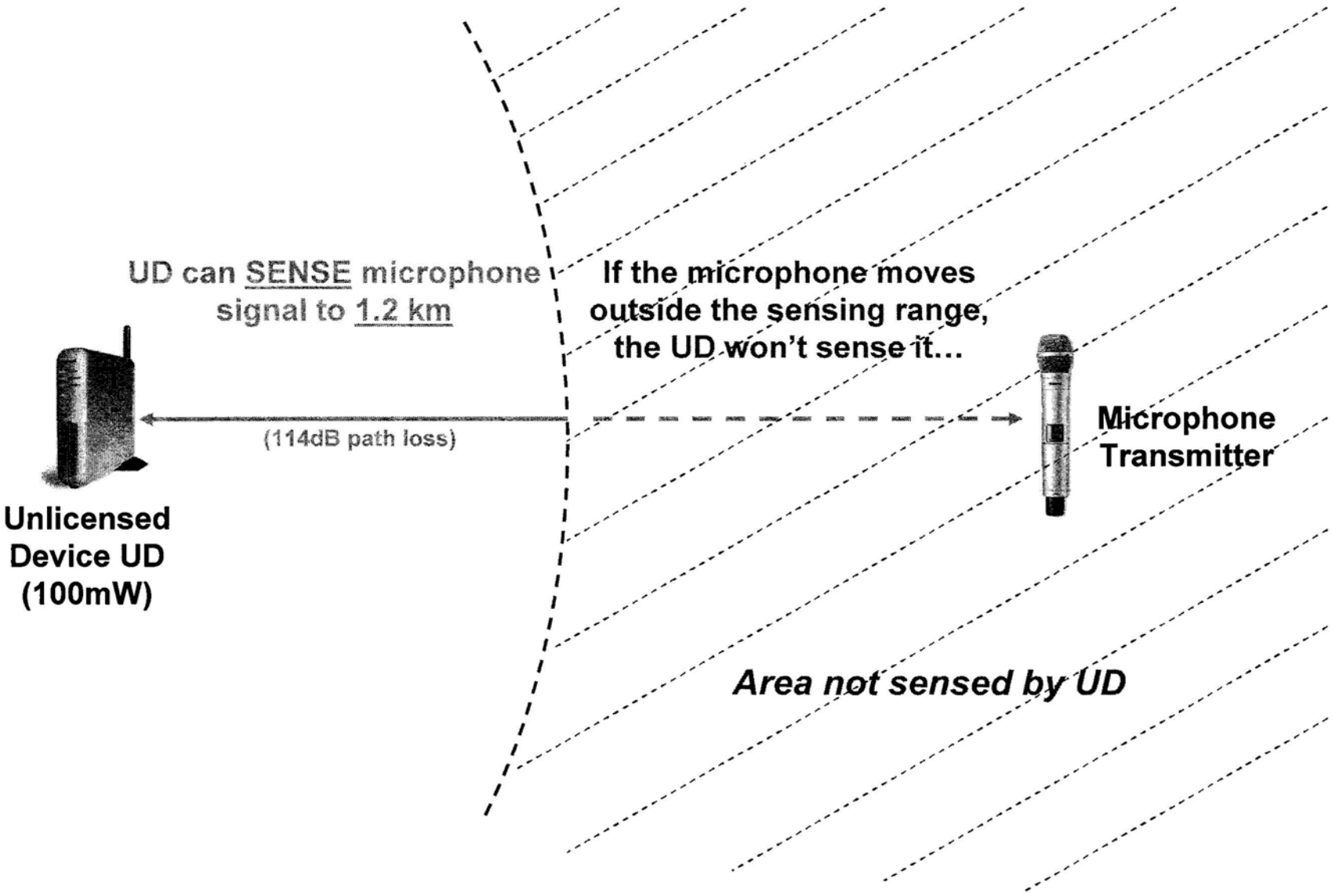
EXAMPLE: Spectrum Sensing



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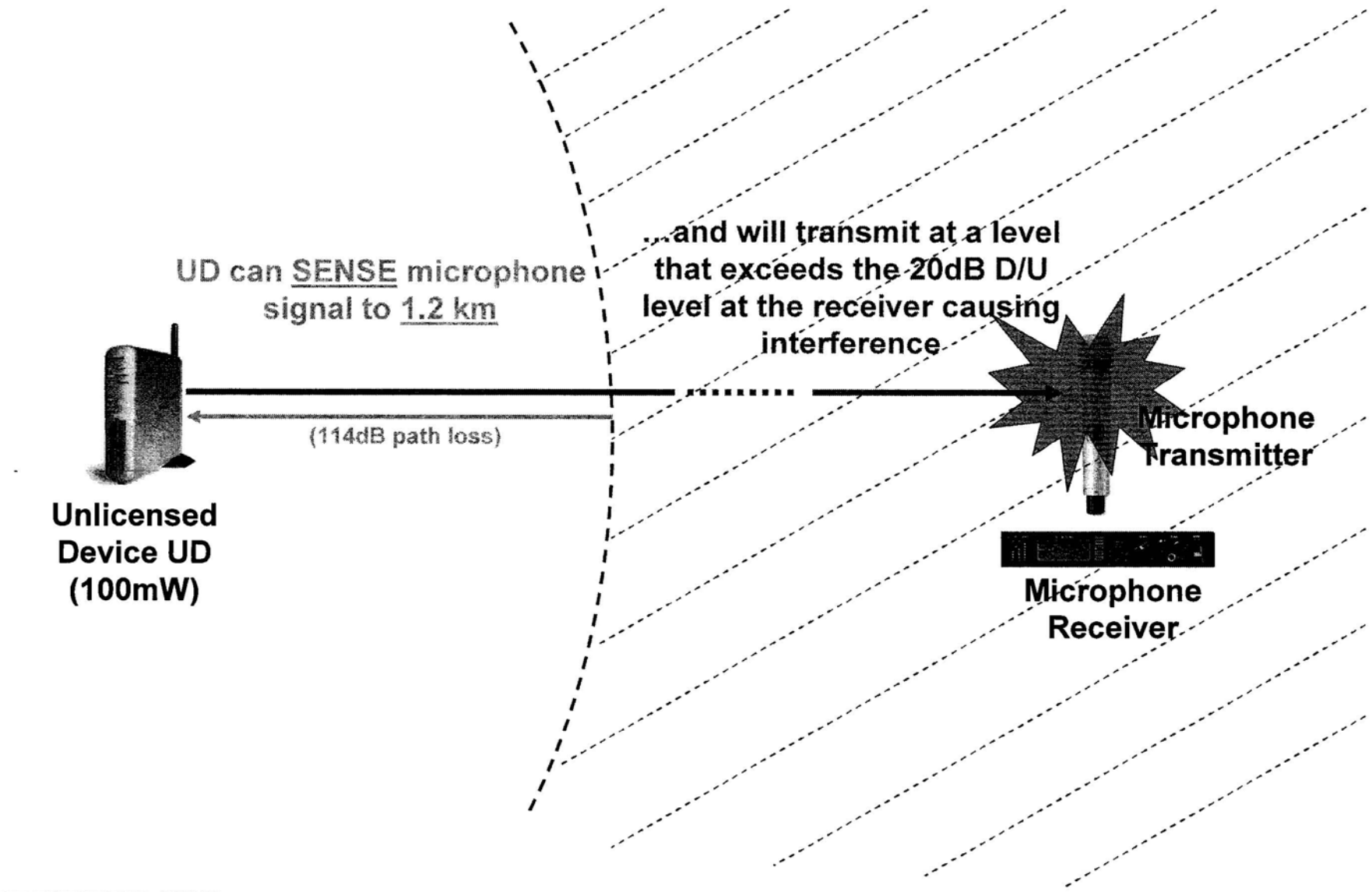
EXAMPLE: Spectrum Sensing



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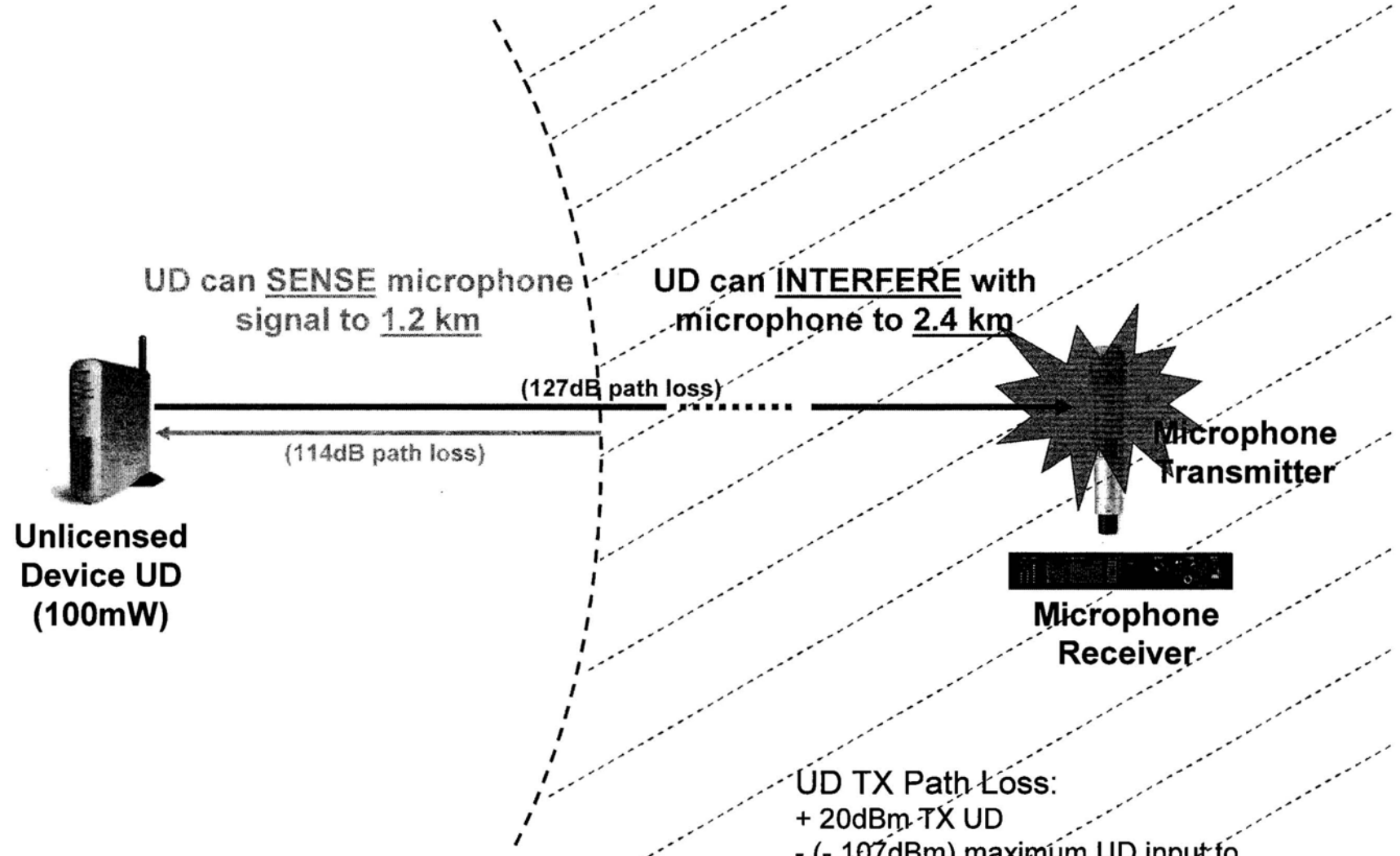
EXAMPLE: Spectrum Sensing



UD TX Path Loss:
+ 20dBm TX UD
- (- 107dBm) maximum UD input to microphone receiver
= +127dB Path Loss (2.4km)

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EXAMPLE: Spectrum Sensing

- **CONCLUSION**: Unlicensed devices transmitting at 100mW as proposed cannot fully protect microphones using spectrum sensing
  - Example for fixed UD at 1W is even more harmful

- IEEE 802 admits sensing can't fully protect wireless microphones; proposed sensing at short range along with a beacon for full protection*

* IEEE 802.18, 04-186 NPRM Comments

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Microphone Solutions (1 of 3)

Spectrum Sensing

- Unlicensed devices can only sense wireless microphones effectively, IF the…

INTERFERENCE range <= SENSING range

- FNPRM discusses same problem w/ radar and 5GHz UD
- Must reduce unlicensed device max transmit power for sensing to protect microphones

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Microphone Solutions (2 of 3)

Beacon Protection

- IEEE 802.22.1 has made significant progress in defining a beacon standard with Shure participation
  - 802.22.1 voting on draft beacon standard in June*
- Rules for any new UD in the TV bands must require IEEE 802.22.1 beacon use for protection of incumbent microphones
  - Beacons are essential to super-scale TV broadcast venues such as hurricane Katrina, political conventions, and the Olympic Games

* IEEE 802, "Part 22.1: Enhanced Protection for Low-Power, Licensed Devices Operating in Television Broadcast Bands"

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Microphone Solutions (3 of 3)

Clear Spectrum

- IEEE 802 concluded and recommended to the FCC that unlicensed devices should not operate in adjacent channels (N+/-1) to TV stations*
  - Supports microphone operation in adjacent channels to avoid interference from unlicensed devices

- Adjacent Channels will provide a "safe harbor" to microphones in urban and suburban areas, but not in rural areas due to lack of TV stations

* FCC DTV Receiver Testing results also substantiate this conclusion

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Microphone Solutions (3 of 3)

Clear Spectrum

- Designating Exempt Channels from UD use prevents interference to microphone operation
  - Shure recommends designating six (6) channels exempt from unlicensed device use
    - two (2) VHF and four (4) UHF channels
  - Adequate available spectrum exists to accommodate this need in rural areas

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Wireless Microphone Solutions

CLEAR SPECTRUM

- Prohibit unlicensed devices from operating in adjacent channels (N+/-1) to TV stations; *and*
- Designate six (6) rural channels exempt from unlicensed device use

IEEE 802.22 BEACON

- Require the IEEE 802.22.1 beacon for microphone protection

SPECTRUM SENSING

- Require unlicensed devices to conduct spectrum sensing for incumbent microphones
  - Must make the sensing range = the interference range of the unlicensed device
  - Must meet Shure-proposed DFS "timing" parameters

The FCC can protect wireless microphones from new unlicensed device interference by adopting these measures into the Part 15 rules:

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